

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Takeaki SAIKI et al. Confirmation No.: 9218
Serial No.: 10/533,169
Group Art Unit: 4171
Filed: April 17, 2006
Examiner: DOLLINGER, Michael M.
For: METHOD FOR THE PREPARATION OF A SILICON-CONTAINING
POLYSULFIDE-TYPE POLYMER

DECLARATION UNDER 37 CFR § 1.132

MAILSTOP: AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

I, Makoto Iwai, hereby state that:

1. I am a citizen of Japan.
2. I have a Doctor of Engineering degree from Chiba University in Chiba, Japan. I am currently employed in a Senior Chemist role for Dow Corning Toray Co., Ltd. of Tokyo, Japan. I have worked in the silicone field for 24 years and I have been employed by Dow Corning Toray Co., Ltd. for the past 24 years.

3. I am the first named and joint inventor of the pending U.S. Patent Application, Serial No. 10/533,169, and am a person highly skilled in the art of silicones including silicone

compositions and methods for producing such silicone compositions including, in particular, silicon-containing polysulfide-type polymers.

4. In the present application, the invention, which is a method for the preparation of a silicon-containing polysulfide-type polymer, includes mixing (A) a silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond; (B) a polysulfide polymer with at least two mercapto groups in one molecule; and (C) an organic base or ammonia in the presence of (D) sulfur.

5. I am aware of, have read, and understand the disclosure of U.S. Patent No. 3,476,826 to Millen (the '826 patent), which is entitled "ORGANO-SILANE MODIFIED POLYSULFIDE POLYMERS AS ADHESIVE ADDITIVES OR PRIMERS FOR HIGH RANK POLYSULFIDE BASED ADHESIVE COMPOSITIONS."

6. For the reasons described in Paragraphs 7-17 immediately below, the invention in the present application is unique and distinguishable from the '826 patent. Specifically, if the teachings and components of Examples 1 and 2 of the '826 patent were to be combined, the silicon-containing polysulfide-type polymer or the method of preparing the silicon-containing polysulfide-type polymer of the invention would not be made or otherwise envisioned.

7. After closely analyzing the '826 patent, I can find nothing in the '826 patent that teaches a method for the preparation of a silicon-containing polysulfide-type polymer by mixing (A) a silicon-containing compound having a silicon atom-bonded monovalent organic

group with an aliphatic unsaturated bond; (B) a polysulfide polymer with at least two mercapto groups in one molecule; and (C) an organic base or ammonia in the presence of (D) sulfur, as claimed for the invention.

8. I recognize that Example 1 of the '826 patent describes a method of preparing a vinyl triethoxy silane polysulfide by reacting a polysulfide polymer and vinyl triethoxy silane in the presence of 2,2'-azobisisobutyronitrile.

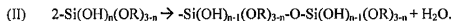
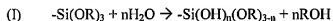
9. I also recognize that Example 2 of the '826 patent describes a method of preparing a high sulfur rank liquid polysulfide polymer by reacting a liquid polysulfide polymer and paraformaldehyde in the presence of triethylamine to form a blocked polysulfide polymer, and subsequently reacting the blocked polysulfide polymer with elemental sulfur, n-dibutylamine, and water.

10. *However*, even with Examples 1 and 2, the '826 patent does not teach a method for the preparation of a silicon-containing polysulfide-type polymer by mixing (A) a silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond; (B) a polysulfide polymer with at least two mercapto groups in one molecule; and (C) an organic base or ammonia in the presence of (D) sulfur, as claimed for the invention. In fact, combining the components of Examples 1 and 2 of the '826 patent would result in a chemical reaction fundamentally different than the reactions utilized in the method of the subject invention.

11. Because the chemical reaction utilized in the invention is fundamentally

different than the reactions of the '826 patent, the end product formed from each respective reaction is different as well. Thus, the end product formed from the method claimed as the invention is both unexpected and unpredictable in view of the teachings of the '826 patent.

12. In particular, in Example 2 of the '826 patent, a blocked polysulfide polymer is reacted with paraformaldehyde in the presence of triethylamine to form a blocked polysulfide polymer. The polysulfide polymer is then reacted with elemental sulfur and catalyzed by n-dibutylamine and water. If Example 2 were to be combined with Example 1, as suggested by the Examiner, the vinyl triethoxy silane *and* the vinyl triethoxy silane polysulfide of Example 1 would react with the water from Example 2 according to the following reaction mechanisms:



In each of the reaction mechanisms (I) and (II) set forth immediately above, the dash (-) in front of the silicon atom illustrates that the silicon atom may be bonded to a carbon atom of a vinyl group, as in the instance in which it is the vinyl triethoxy silane which is reacting with water, or the silicon atom may be bonded to an atom in a polysulfide polymer, as in the instance in which it is the vinyl triethoxy silane polysulfide which is reacting with water. As known throughout the art, reaction mechanism (I) is commonly referred to as a hydrolysis reaction, and reaction mechanism (II) is commonly referred to as a condensation reaction. Notably, water is not included in the chemical reaction of the method in the invention. As

such, there is neither a water-initiated hydrolysis reaction, as represented by reaction mechanism (I) above, nor a condensation reaction of hydrolysates formed from a water-initiated hydrolysis reaction, as represented by reaction mechanism (II) above, in the invention.

13. In addition, after closely analyzing the '826 patent, I can find nothing in the '826 patent that teaches the advantages of utilizing an organic base or ammonia in combination with elemental sulfur during the reaction between an a silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond and a polysulfide polymer with at least two mercapto groups in one molecule.

14. In particular, Example I of the '826 patent reacts a polysulfide polymer having two mercapto groups per molecule and vinyl triethoxy silane. This reaction is catalyzed by 2,2'-azobisisobutyronitrile, which is known in the art as a radical initiator, and is neither an organic base nor ammonia. In addition, the reaction requires a temperature of up to 110 °C. Therefore, after closely analyzing Example I of the '826 patent, I can find nothing which teaches utilizing an organic base or ammonia *or* elemental sulfur to catalyze a reaction between a polysulfide polymer having two mercapto groups per molecule and vinyl triethoxy silane, let alone the utilization of an organic base or ammonia *and* elemental sulfur to catalyze such a reaction, as used in the invention.

15. The advantages of utilizing the organic base or ammonia in combination with

sulfur to catalyze the reaction between a polysulfide polymer having two mercapto groups per molecule and vinyl triethoxy silane are exemplified in Comparative Examples 1 and 2 of the subject application. In particular, in Comparative Example 1, a silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond and a polysulfide polymer with at least two mercapto groups in one molecule were mixed with an organic base. Notably, the reaction between the silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond and the polysulfide polymer with at least two mercapto groups in one molecule did not occur. Similarly, in Comparative Example 2, the silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond and the polysulfide polymer with at least two mercapto groups in one molecule were mixed with elemental sulfur. Once again, the reaction between the silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond and the polysulfide polymer with at least two mercapto groups in one molecule did not occur.

16. I recognize that Example 1 of the '826 patent describes a method of preparing a high sulfur rank liquid polysulfide polymer utilizing triethylamine and elemental sulfur. *However*, the triethylamine and the elemental sulfur are utilized in subsequent steps and for different purposes. In particular, the triethylamine is used in combination with paraformaldehyde to block the -SH groups of a liquid polysulfide polymer to form a blocked polysulfide polymer. *Then*, the blocked polysulfide polymer is reacted with n-dibutyl-amine,

water, and elemental sulfur to form the high sulfur rank liquid polysulfide polymer. Notably, this is not a reaction between a silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond and a polysulfide polymer with at least two mercapto groups in one molecule. As such, the organic base and the elemental sulfur are utilized in a *different* type of reaction between *different* components than in the invention.

17. Therefore, I believe that after closely analyzing the '826 patent, one of skill in the art, such as myself, would have no reason whatsoever to react a silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond, a polysulfide polymer with at least two mercapto groups in one molecule, and an organic base or ammonia in the presence of sulfur, as claimed as the invention.

Conclusion

18. As a result of my review of the '826 patent and also as a result of my understanding from a perspective of a person skilled in the art, the invention as claimed at the time of filing the patent application presented, and still presents, significant differences from the '826 patent. Specifically, the '826 patent does not teach a method of preparing a silicon-containing polysulfide-type polymer by mixing (A) a silicon-containing compound having a silicon atom-bonded monovalent organic group with an aliphatic unsaturated bond; (B) a polysulfide polymer with at least two mercapto groups in one molecule; and (C) an organic base or ammonia; wherein the mixing takes place in the presence of (D) sulfur, as in the

invention.

19. In addition, the '826 patent only broadly discloses each of components (A)-(D), which were already well known in the art. However, I would have no reason whatsoever to select vinyl triethoxy silane and a polysulfide polymer from Example 1 of the '826 patent, while excluding 2,2'-azobisisobutyronitrile, which was known in the art to catalyze polymerization. Further, I would have no reason whatsoever to select triethylamine and elemental sulfur from Example 2 of the '826 patent, while excluding water and the step of reacting the polysulfide polymer with paraformaldehyde, and mixing the triethylamine and elemental sulfur with the vinyl triethoxy silane and the polysulfide polymer of Example 1 to form a silicon-containing polysulfide-type polymer.

20. I hereby declare that all statements made herein of my own knowledge are true

and that all statements made on information are believed to be true, and further that these statements were made with the knowledge that willful and false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or patent issued thereon.

Respectfully submitted,

Jan. 23, 2009

Dated

Makoto Iwai

Makoto Iwai